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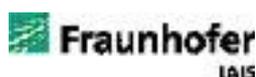
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Summary

This deliverable summarizes the project's evaluation activities for all three Use Cases and particularly the evaluation of the Dicode workbench and integrated services. The evaluation process followed during the two evaluation phases of the project is briefly described, together with the feedback received based on the initial and enhanced suite of services presented to evaluators. Also, we discuss the assessment of the project's results by Use Case experts, as well as by bodies/communities that are not directly involved in the project. Finally, the document comments on how the feedback provided in the first and second evaluation phases was taken into account, and presents our insights on how Dicode project can be further evaluated, given its usability and acceptability.

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1. Introduction

1.1 Context

This deliverable summarizes the Dicode's evaluation activities relative to the project's Use Cases. Specifically, it briefly presents the overall evaluation framework (presented in detail in deliverable D6.1), the outcome of the evaluation of the initial versions of Dicode services (presented in detail in deliverables D6.2.1, D6.3.1 and D6.4.1), and the outcome of the evaluation of their enhanced version through the Dicode workbench (presented in detail in deliverables D6.2.2, D6.3.2 and D6.4.2). Furthermore, it reports on the assessment of the Dicode workbench and integrated services from experts/bodies that are not directly involved in the project.

1.2 Objectives

This is the final deliverable of WP6 reporting on the validation and assessment of the developed Dicode services through the three use cases of the project, namely:

- Use Case #1: Clinico-Genomic Research Assimilator (CGRA),
- Use Case #2: Trial of Clinical Treatment Effects (TCTE),
- Use Case #3: Opinion Mining from Unstructured Web 2.0 Data (OMUWD).

While the focus of the previous WP6 deliverables (D6.1, D6.2.1, D6.2.2, D6.3.1, D6.3.2, D6.4.1, D6.4.2) was on introducing the evaluation framework and assessing the Dicode services that were especially developed for the use cases, this deliverable (D6.5) aims to summarize the evaluation results, and comment on the assessment of the project's outcome from external experts/bodies or communities.

1.3 Structure

In Section 2, we present an overview of the first evaluation round and briefly explain its outcome whilst highlighting the key issues raised by the evaluators. The project reviewers' comments are also discussed in relation to the evaluation's outcome. In Section 3, information about the process of the second evaluation round for all Use Cases is provided, emphasizing on the characteristics of the enhanced services now integrated into the Dicode workbench. Section 4 reports on the assessment of the Dicode workbench and integrated services from experts/bodies that are not directly involved in the project.

2 First evaluation round

2.1 Goals and framework

The Dicode workbench and corresponding innovative work methodologies were evaluated based on how they can improve the everyday practice of real senior users from the three Use Cases during the processing of voluminous, complex and heterogeneous data sets, whilst enhancing collaboration, decision making, social sharing and collective sense making.

The evaluation of the Dicode services was performed based on a series of Key Success Indicators (KSIs) outlined in D6.1, overall aiming to assess:

- the maturity of the technology used through Technology Readiness Level (TRL);
- the project-specific dissemination and exploitation activities;

- the usability and acceptability of Dicode services in all Use Cases.

Emphasis was given to those KSIs measuring usability and acceptability of the Dicode services. The cost-effectiveness and readiness for the market of Dicode services were also assessed. The evaluation results and feedback were collected and critically presented in order to serve as a guideline for the service providers to improve the Dicode suite of services and specifications, as well as to further increase their usability and overall quality.

During the first evaluation round of the project, the Dicode workbench and ten services of the project were evaluated (see Table 2.1). At the time of the first evaluation round, two of the services were integrated into the Dicode workbench, whereas the rest were evaluated as standalone software.

Services	Characteristics	Indication of integration in the Workbench	Use Case
Workbench	The Dicode integration platform for data analysis and collaboration.	-	All
Collaboration & Decision Making Support	Exploits user's and machine's reasoning abilities to facilitate sense-making, decision making and collaboration.	Integrated	All
Storage	Share and exchange of information (data sets, reports etc.).	Integrated	All
Forum Summarization	Identify topics in discussion threads of particular public forums.	Stand-alone	Use Case #1
SubgroupDiscovery	Estimates subgroups in user specified data sets.	Stand-alone	Use Case #1
Recommendation	Recommends similar users or documents.	Stand-alone	Use Case #1
Augmentor & Semantic services	Delivers pertinent information to the medical community by revealing trends within a trial and provides consistent recording.	Stand-alone	Use Case #2
Blog pre-processing	Returns a condensed representation of weblogs entries containing only significant nouns.	Stand-alone	Use Case #3
Topics	Topic detection identifies and clusters content by building meta topics automatically.	Stand-alone	Use Case #3
Keytrends	The service returns metadata about Tweets on a selected day.	Stand-alone	Use Case #3
Twitter pre-processing	It returns a condensed representation of Tweets containing only significant nouns.	Stand-alone	Use Case #3

Table 2.1: Dicode services evaluated during the first evaluation round.

The first evaluation round was conducted according to the Dicode Evaluation Framework (initially presented in D6.1 and - to some extent - updated in D6.2.1). In what follows, we are highlighting the main technical characteristics of the evaluation procedure:

- Use case partners and technical partners invited participants to join the user trials.
- Due to the fact that the majority of developed RESTful Dicode Services produced output in Json format¹ (Crockford, 2006), the target population was defined to be mainly computer/informatics scientists with considerable knowledge in Web Programming and Web Engineering.
- The Dicode Services evaluators' volunteer sample consisted of 61 evaluators from the four participant countries of the project (Greece, Spain, Germany and United Kingdom).
- Especially for the Augmentor evaluation, five Dynamika software developers from IMA were recruited.
- The sampling method used was Snowball sampling (Kitchenham and Pfleeger, 2002).
- Five questionnaires (three taken from D6.1 and another two that were designed and tested for the Forum Summarization service) were distributed to evaluators together with the Dicode Evaluators' Guide, aiming to gather mainly quantitative but also qualitative feedback (wherever appropriate).
- Evaluators were asked to carefully read the instructions, have a 'hands-on' session for each service and finally fill in the questionnaires.
- Summaries of the evaluation analysis results presented were produced using the Statistical Package for the Social Sciences (SPSS 17v) routines.
- Due to the nature of Use Case #3 data sets, we also decided to conduct 10 interviews with marketing professionals in order to analyze the requirements and the specific challenges of social media monitoring. A detailed list of these professionals is given in deliverable D6.4.1 (pages 11-12).
- Summary statistics were presented in D6.2.1, D6.3.1 and D6.4.1, whereas detailed statistics relevant to the completed questionnaires collected for the three Dicode Use Cases' evaluation were uploaded in the Dicode wiki².

2.2 Outcome and related actions

Based on the feedback received from the first evaluation phase of the Dicode project, the Dicode workbench was reported to be a promising tool, which facilitates users to set their research objectives and better understand the data and methodologies used in their research. The vast majority of the evaluators appreciated the potential of exploiting the synergy of machine and human reasoning through data mining and collaborative decision making services. The innovative approaches on the text-mining services seemed to be appreciated by evaluators, who generally agreed on the usefulness and acceptability of the provided services. Nevertheless, additional work was essential towards the improvement of Dicode services in terms of their documentation, user interfaces and performance. Another issue raised concerns testing of these services in various data-intensive and cognitively-complex contexts, in order to further assess their applicability and potential, and gradually build their generic nature.

In Table 2.2, we summarize the main points raised by the reviewers per service evaluated and state the actions that took place to address them. The issues marked with an asterisk (*) were addressed in the second evaluation round.

¹ <https://tools.ietf.org/html/rfc4627>

² See <https://wiki.dicode-project.eu/display/DIC/WP6+Evaluation+results>

Services	Issues raised	Action taken
Workbench and integrated Storage service	Technical issues involving its performance and interface*.	UPM, CTI: improve performance & user-friendliness
Collaboration & Decision Making Support	Technical issues involving its performance and interface. More detailed or differently structured scenarios needed*.	CTI: improved performance & user-friendliness
Forum Summarization	Relatively limited functionality of the service to extract topics and search for relations.	Discontinued as other Dicode services may better address the issue
SubgroupDiscovery	Technical issues involving its interface, and presentation of results. Increase flexibility of the service by applying it to additional data*.	FHG: improved service's functionality, usefulness and flexibility
Recommendation	Technical issues involving its interface and outcome.	FHG: improved service's functionality and usefulness
Augmentor & Semantic services	Technical issues involving interface.	UOL: Made interface more user friendly

Table 2.2: Dicode first evaluation round: issues raised and actions taken (issues marked with an asterisk were addressed in the second evaluation round).

3 Second evaluation round

3.1 Goals and framework

For the second evaluation round, all technical partners have worked towards finalizing the enhanced version of all Use Cases' services. The evaluated services were integrated into the Dicode workbench; particularly, the evaluated services were enhanced based on all issues raised by the evaluators during the first evaluation round, as well as on concerns expressed by the project's reviewers and Project Officer during the second review meeting of the project. Table 3.1 presents the services evaluated during the second evaluation round.

We focused on evaluating the services' usability to facilitate collaborative processing of diverse data-intensive and/or cognitively-complex tasks. In order to address this issue, we produced and exploited videos to assess the usability of Dicode workbench and associated services; this practice has been suggested in the literature towards supporting the collaborative behaviours that facilitate mutual participation (Cheng et al., 2010).

Services	Characteristics	Indication of integration in the Workbench	Use Case
Workbench	The Dicode integration platform for data analysis and collaboration.	-	All
Collaboration & Decision Making Support services	Exploits user's and machine's reasoning abilities to facilitate sense-making, decision making and collaboration.	Integrated	All
Storage	Share and exchange of information (data sets, reports etc.).	Integrated	All
SubgroupDiscovery	Estimates subgroups in user specified data sets.	Integrated	Use Case #1
Augmentor service	Support of data analysis, collaboration and decision making.	Stand-alone	Use Case #2
Topic Graph service	Applied for identification of competitive topics.	Integrated	Use Case #3
Top Entity service	Allows to discover discussion/conversation about certain topics (type, domain, time).	Integrated	Use Case #3
Name Entity service	Context sensitive search which excludes unwanted synonyms.	Integrated	Use Case #3
Prominence Graph	Connects peak analysis with the website where mention originates (through Google).	Integrated	Use Case #3
Phrase Extraction service	Allows extracting different types of phrases from a text collection in a trainable manner.	Integrated	Use Case #3

Table 3.1: Dicode services evaluated during the second evaluation round.

The main technical characteristics of the second evaluation round were the following:

- Use case partners invited participants to join the user trials.
- Ten participants were recruited for each use case.
- In all cases, evaluators were senior members of the biomedical, medical, and marketing communities (for CGRA, TCTE, OMUWD, respectively), who were able to assess the project's outcomes with the help of videos.
- The sampling method used was Snowball sampling (Kitchenham and Pfleeger, 2002).
- Evaluators were shown scenario-based videos for each use case in order to assess the Dicode workbench and integrated services. Videos were used to emphasize the diversity of the tasks performed in the Dicode workbench and demonstrate the functionalities of the integrated services.
- Online questionnaires via Google Docs platform were distributed to evaluators in order to collect quantitative and qualitative feedback, based on the videos they have previously watched.
- Summaries of the evaluation analysis results were produced using the Statistical Programming language R 2.15.3 and routines supplied via Google Docs platform.
- Due to the nature of Use Case #3 data sets, we also decided to conduct 5 specially structured interviews with marketing professionals in order to analyze the relevance of social media monitoring in corporate structures (also comparing them to the results of the first evaluation round) and their general opinion about the Dicode

Workbench and integrated services. A detailed list of these professionals is given in deliverable D6.4.2 (page 17).

- Summary statistics were presented in D6.2.2, D6.3.2, and D6.4.2, whereas detailed statistics relevant to the completed questionnaires collected for the three Dicode Use Cases' evaluation were uploaded in the Dicode wiki³.

3.2 Outcome and related actions

Based on the feedback received from the second evaluation phase of the Dicode project, the Dicode Workbench interface was reported to be intuitive with well integrated services; additionally, evaluators had a few suggestions for further enhancing its ease of use. Evaluators were satisfied with the information provided by the videos, although they reported that extra time was needed to familiarize with the Workbench. They were sceptical about adopting new practices but less sceptical for the ability of the Dicode Workbench and integrated services to deal with data-intensive and cognitively-complex issues, to enhance collaboration between their peers, and in that respect assist exchanging of information and advice. The collaboration and decision-making support services of Dicode were highly marked; special mentions include functionalities related to the evolution of collaboration and provenance of associated data, and the different manners of sharing or discussing data and results. Furthermore, they reported that the platform offers ease of communication and strong data/information archiving features.

Overall, evaluators deemed that the Dicode platform brings potential benefit to their work and provides sufficient services to support their work. Nevertheless, they were reluctant to use the Dicode services without further familiarization.

In assessing the Augmentor (Use Case 2), the evaluators believed it could help them with data-intensive and cognitively-complex issues. However, they did not dismiss the fact that a longer evaluation period of the service would have helped to understand it and make better judgements about it. It was also noted that the Dicode user interface could be more intuitive for faster user adaptability.

4 Additional assessment activities

Throughout the project, the initial and enhanced Dicode services were presented to bodies and communities dealing with the field of collaboration and decision-making from different scientific fields. For each use case, we include here a list of groups of experts and communities where we presented the Dicode platform, and comment on the structure of the audience and the feedback collected.

4.1 CGRA assessment activities

Use Case 1 aimed to cover a wide range of activities in order to be able to handle big and diverse data from the biomedical domain. This is an extremely fast developing and competitive field, which keeps its pace along with the technological developments in the biomedical domain and particularly in the genomic, transcriptomic and sequencing technologies for producing the corresponding data. Recently, there were presented some stand-alone platforms with great capabilities in exploiting biomedical activities; however,

³ See <https://wiki.dicode-project.eu/display/DIC/WP6+Evaluation+results>

they focus on either data-mining options, e.g. the Chipster software (Kallio et al., 2011), or on collaborating and sharing information between users, such as myExperiment platform (Goble et al., 2010).

The novelty of the Dicode workbench under the CGRA Use case lies in integrating the collaboration and decision-making services, together with enhanced data-mining capabilities. Thus, aiming to emphasize the above novelty of the Dicode platform, and furthermore to underline the fact that diverse data can be accommodated, we approached different groups of experts for the assessment of the Dicode platform; this is a parallel to the two evaluation rounds activity, aiming to the assessment (and consequent enhancement of the platform) by broadly recognized experts. As can be seen in Table 4.1, CGRA Use Case was presented to experts from the biomedical and other relevant fields who, even if they were not directly interested in the data analyzed by Use Case 1, they could find many similarities on the volume of the data, their structure and diversity.

Groups of experts/ Communities	Scientific area	Feedback
SEQAHEAD, COST EU project (http://www.nextgenerationsequencing.org/)	Biology/ Bioinformatics	Focus on Dicode's data-mining services and their data integration capabilities.
BIOASQ EU project (http://bioasq.org/)	Bioinformatics/ Computing	Focus on the data-mining services, their applications and usability.
Granatum EU project (http://granatum.org/)	Biomedical/ Medical/ Bioinformatics/ Computing	Share and exchange of information for the collaboration and decision-making services.
University of Montpellier, France	Biology/ Bioinformatics	Suggest the inclusion of data-mining capabilities for the analysis of extra data.
CSC-IT Center, Finland	Bioinformatics/ Computing/ Mechanical engineering	Focus on the data-mining services, their applications and usability.
University of Athens, Greece	Biology/ Bioinformatics	Presentation of the visualization options offered, as well validation of results (collaboration/ decision making).
Biomedical Research Foundation, other Divisions: - Molecular Biology - Immunogenetics - Biotechnology - Developmental Biology - Proteomics	Biomedical/ Medical/ Biology	Focus on the data-mining options offered via the Dicode workbench, and how these can accommodate diverse biological data.
Chipster platform (http://chipster.sourceforge.net)	Biology/ Bioinformatics/ Computing	Presentation of data-mining, collaboration, and decision-making services, as integrated in the Dicode platform. The audience was very keen to further exploit the Dicode workbench, since they are currently developing an enhanced version of the Chipster software.

Table 4.1: Groups of experts assessed the CGRA Dicode services.

In all cases, a short presentation of the Dicode platform together with a video presentation based on a representative scenario, were shown. From Table 4.1, we can observe that a wide range of rapidly evolving fields is covered, i.e. biomedical, medical, bioinformatics, informatics and computing. Nevertheless, the feedback collected focuses mainly on the capabilities of data-analysis, collaborative and decision-making services. Other issues concerning the usability of the interface and help files were raised. All comments/feedback were further discussed with technical partners.

4.2 TCTE assessment activities

Use Case 2 aimed to cover situations foreseen in clinical trials where a multi-disciplinary team who are based in various locations need a platform for collaboration and decision making. The Dicode Workbench and the Augmentor service were introduced to a group of medical and clinical trial evaluators to gather their views on the usefulness of such services. In particular, the goal of the second evaluation round was to simulate a multi-tasking environment where users need to work on diverse tasks. Based on the above, a real working scenario was presented to the evaluators via three video-casts to demonstrate Dicode's collaboration, decision-making and Augmentor services.

Expert groups	Area of Expertise	Feedback
Radiologists	Musculoskeletal, Neurology, Cardiology and Oncology Imaging	Focus on collaborative decision making.
Researchers	Osteoarthritis, Rheumatoid Arthritis, Prostate cancer, Multiple Sclerosis, Brain tumours	Focus on the data-mining services, their applications and usability.
Clinical Trial Operations Team	Running clinical trials	Share and exchange of information for the collaboration and decision-making services between multi-site participants
Statisticians	Bioinformatics	Include ability to run statistical analysis using R, SAS and other tools.
IMA Technical Team	Medical imaging software development and quantitative analysis	Create a user friendly interface and be able to integrate to other applications easily.

Table 4.2: Groups of experts assessed the TCTE Dicode services.

Various expert groups conducted to assess Dicode services throughout the project are shown in Table 4.2. Overall, the evaluators felt that having a voice over for the videos could have helped sustain their attention. Evaluators had mixed feelings about Dicode's collaborative and decision making support functions. Some users saw this as an advantage because it wasn't time or location specific and it was praised for being able to track written conversations and ideas which usually can get lost during a verbal meeting. The negative users saw this as a risk for miscommunication and inefficiency, however highlighted that ultimately it is environment and scenario dependant, i.e. a team of users in the same hospital could find that meeting up is easier and quicker than writing their thoughts electronically.

The general consensus was that the Dicode Workbench could bring potential benefit to the users' work with capable services for support, however when asked if they would introduce the service into their workflow soon, many users were reluctant. As with most software, there is the issue of change management, which every organisation would need to deal with whenever something new is implemented.

4.3 OMUWD assessment activities

Use Case 3 aimed to evaluate the Dicode services with respect to the automatic analysis of voluminous amount of unstructured information. The Dicode services were thoroughly evaluated based on how they can improve collaboration and decision making in OMUWD settings, so as to support well-informed marketing decisions and strategies.

Topic and Event	Experts/ Communities	Feedback
Speech and panel discussion at the International Conference in Bernburg 26 - 27 May 2011, Anhalt University, Bernburg; Topic Monitoring. Presentation of the Dicode Approach (conference title: "Demands on the structures and instruments of economics in the context of globalisation").	Research, Agriculture	Approach raised high interest, a bunch of requirements had been discussed, e.g. importance of international standards, reliability, influencer detection, proper sentiment.
Panel discussion and workshops at the Marketing Horizonte in Cologne, 14 - 15 September 2011. Discussion of the meaning of Social Media and Social Media Monitoring for brands. Presentation of the Dicode approach (titled "I love this brand").	Marketing students and marketing managers	Discussion on Social Media as a new means for brand building and dialogue with consumers. The Dicode approach was highly appreciated, particularly the developments concerning influencer and sentiment analysis.
Panel discussion and workshops at the Digital Marketing Congress in Frankfurt, 10 December 2011. Presentation of the Dicode approach (titled "E-commerce in times of Facebook, Twitter & Co.").	Marketing students and marketing managers	Intense discussion on how to make Social Media Monitoring fit marketing needs.
Speech and workshops at the webinale - the holistic web conference, 3 - 5 June 2013. Presentation of the Dicode influencer service (titled "Influence the influencers").	Advertisers, marketing managers and developers from various industries	Very positive feedback on the influencer services and intensive discussion on future requirements concerning Social Media Monitoring.
Panel discussion at the Bonner Management Forum, 6 June 2013. Presentation of several Dicode services (titled "Digital business models - companies re-invent themselves").	Marketing managers from various industries	Highly intensive discussion about the need of viable data analysis to master the digital change.
Panel discussion with interested citizens. SPD-Forum in Rüsselsheim, 14 June 2013. Presentation of the Dicode approach and its effects on consumers (titled "The see through customer").	Politicians, citizens	Intensive discussion about advantages and disadvantages of Social Media Monitoring for consumers. Strong call for transparency and data protection.

Table 4.3: Groups of experts assessed the OMUWD Dicode services.

In parallel to the two evaluation rounds of the project, the novelty of Dicode Workbench and OMUWD related Dicode services was assessed by various groups of experts/communities in the context of specific events. As shown in Table 4.3, the Dicode approach for the OMUWD Use Case was mainly presented to marketing professionals, social media monitoring (SMM) tools developers, as well as politicians and citizens. Generally speaking, feedback collected was very positive: the Dicode approach raised much interest, the proposed services' innovative functionality was highly appreciated, while a series of experts' remarks were taken into account during the development of the OMUWD-related services.

5 Conclusion

Overall, the Dicode workbench and integrated services were reported to constitute an interesting platform showing great capabilities as far as the data-mining, collaboration and decision-making services are concerned. We found that there is great potential for adaptation and application of the Dicode platform in a wide range of different organisations. The generic characteristics of the platform, mainly in the collaboration services, were thought to be satisfactory, in covering a wide range of everyday activities, and user-friendly. Nevertheless, there is need for a continuous enhancement of the data-mining services given the diversity of the associated data. Summarizing, the target users and key 'application domains' identified were:

- Use Case #1: Wider Medical and Biomedical domain (e.g. genetics, proteomics, molecular biology and immunology), computing, and informatics.
- Use Case #2: Predominantly medical community who are involved in collaborative research, multi-disciplinary patient care pathway decision making and multi-centre clinical trials.
- Use Case #3: Communication agencies, SMM Tools providers and companies (especially marketing and communication departments) wanting to gain precise consumer knowledge and insight to shape their communication strategy and tactics.

We believe that the above findings, derived by our effort to jointly evaluate and disseminate the project, show that there are many generic characteristics incorporated into the Dicode platform, and that there is great potential for further enhancement and up-to-date development in order to approach highly specialized target users.

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